

Bogg's Lake Hedge-Hyssop

(*Gratiola heterosepala*)

Status

Federal: None

State: Listed as Endangered (November 1978)

Other: California Native Plant Society List 1B

Recovery Plan: None

Placer Legacy Category: Class 1



Distribution

North America

Bogg's Lake hedge-hyssop is found in California and in Lake County, Oregon.

California

Bogg's Lake hedge-hyssop was first collected in Lake County, California, in 1923 (Mason and Bacigalupi 1954). Until the 1980s, it was known from only a few sites in Lake, Madera, and Sacramento Counties. During the 1980s, an additional 20 occurrences were recorded in Shasta, Fresno, Placer, Sacramento, Lake, and Modoc Counties, and one occurrence was recorded in Oregon. Many more records were added during the 1990s, and the California Natural Diversity Database (CNDDB) now lists 85 extant occurrences of this species, including one that is possibly extirpated (California Natural Diversity Database 2002). There are two primary concentrations of the species: one on the Modoc Plateau and one in the eastern Sacramento Valley (California Natural Diversity Database 2002).

The distribution of Bogg's Lake hedge-hyssop populations is patchy throughout its range, even in areas of suitable habitat. Uneven distribution and abundance may be due to artificial or natural factors, including historic land management practices (e.g., disking or land leveling) and site characteristics (i.e., species range, soil types, and landforms).

Placer County Phase I Planning Area

Historical

Bogg's Lake hedge-hyssop was not recorded in Placer County until the mid-1980s, when three populations were located.

Current

Bogg's Lake hedge-hyssop is currently known from only 3 occurrences in the Phase 1 Planning Area. Two of these occurrences are located between Rocklin and Roseville; the third is located just north of Lincoln.

Population Status & Trends

California

Populations of Bogg's Lake hedge-hyssop, like those of many vernal pool species, fluctuate in abundance from year to year depending on the amount of rainfall. When a vernal pool containing Bogg's Lake hedge-hyssop seed does not fill sufficiently, the seeds may not germinate. Estimates of some populations have fluctuated from no plants in a dry year to thousands in a wet year. The most abundant populations recorded are at Jepson Prairie in Solano County; Jepson Prairie supported an estimated million plants in 1993 and 1995, both of which were wet years (California Natural Diversity Database 2002). Population size at the type locality at Bogg's Lake has varied from 1,000 plants in 1981, to none from 1989 through 1997, to five in 1997 (California Natural Diversity Database 2002).

Placer County Phase I Planning Area

Two of the three populations in Placer County were reported to be threatened by proposed urban development in 1987 and 1989 (California Natural Diversity Database 2002). The current status of these populations is unknown; however, they are presumed to be extant. The third population was observed in 1986 on private land and has not been observed since. The current status of this population is also unknown; however, it is also presumed to be extant (California Natural Diversity Database 2002).

Natural History

Life History

Bogg's Lake hedge-hyssop is a small, semi-aquatic, herbaceous annual that grows to approximately 2–10 centimeters (0.8–3.9 inches) tall (Wetherwax 1993). Each plant generally produces only one or two flowers. The tubular bilateral corolla has two yellow upper lobes and three white lower lobes. The flowers appear yellow from a distance. The blooming period for Bogg's Lake hedge-hyssop is between April and June, while the vernal pools are still inundated with less than 5 centimeters (2 inches) of water (California Native Plant Society 2001).

Habitat Requirements

Bogg's Lake hedge-hyssop occurs in vernal pools primarily on saturated clay (adobe) soils and, at the Bogg's Lake Preserve, on shallow lake margins. Less frequently, this species has been found on loam and loamy sand soils. In smaller vernal pools, it inhabits barren, muddy areas on extremely shallow soils (California Department of Fish and Game 1996, 1998). Some northern California occurrences are on slightly acidic soils (Corbin et al. 1994). It has also been found in deep vernal pools and has occurred as a volunteer species in created vernal pools in Sacramento County and in an artificial clay-lined habitat in Siskiyou County (California Natural Diversity Database 2002).

Reproduction and Dispersal

Bogg's Lake hedge-hyssop seeds germinate when pools become inundated, and growth begins underwater. The plants complete a rapid life cycle during the period when vernal pools have begun to dry but still contain shallow water up to 5 centimeters (2 inches) deep (Kaye et al. 1990; Corbin et al. 1994). Bogg's Lake hedge-hyssop, which flowers between April and June, is thought to be self-pollinated (Kaye

et al. 1990). Studies in Oregon found that seed production was unchanged whether or not insects were excluded during flowering. Insects were not observed visiting flowers under natural conditions (Kaye et al. 1990). Fruits mature within 1–2 weeks after flowering begins. Soon after seed set, the plants die and the seeds disperse (Corbin et al. 1994). Seed dispersal agents have not been studied, although CNDDDB records for two Tehama County occurrences note that seeds may have been carried to the site (by birds or humans) from nearby occurrences (California Natural Diversity Database 2002). Seed longevity in nature has not been studied, although an interval of 3 years between observations of growing plants on the Lassen National Forest indicates that dormancy can persist for at least that long. Flowering at higher elevations occurs as late as August. (Corbin et al. 1994.) Dead plants disintegrate rapidly, leaving no identifiable remains in the dry pools.

Ecological Relationships

Populations are usually composed of scattered individuals, but plants have been observed aggregated in groups within cattle hoof prints (Mason and Bacigalupi 1954). Bogg's Lake hedge-hyssop often grows in association with bractless hedge-hyssop (*Gratiola ebracteata*) and Orcutt's quillwort (*Isoetes orcuttii*) in sparsely vegetated areas. Other vernal pool associates include hairy clover-fern (*Marsilea vestita* subsp. *vestita*), popcornflowers (*Plagiobothrys* spp.), downingias (*Downingia* spp.) Howell's quillwort (*Isoetes howellii*), Nuttall's quillwort (*Isoetes nuttallii*), coyote thistle (*Eryngium* spp.), woolly-heads (*Psilocarphus* spp.), creeping spikerush (*Eleocharis macrostachya*), and smooth goldfields (*Lasthenia glaberrima*).

Bogg's Lake hedge-hyssop also co-occurs with several other rare plants, including slender orcutt grass (*Orcuttia tenuis*), Greene's tuctoria (*Tuctoria greenei*), succulent owl's-clover (*Castilleja campestris* subsp. *succulenta*), hairy orcutt grass (*Orcuttia pilosa*), Hoover's spurge (*Chamaesyce hooveri*), legenere (*Legenere limosa*), many-flowered navarretia (*Navarretia leucocephala* subsp. *plieantha*), Sacramento orcutt grass (*Orcuttia viscida*), and San Joaquin Valley orcutt grass (*Orcuttia inaequalis*) (California Natural Diversity Database 2002). Within the Phase 1 Planning Area, Bogg's Lake hedge-hyssop occurs with dwarf downingia (*Downingia pusilla*) (California Natural Diversity Database 2002).

Population Threats

Although many new populations of Bogg's Lake hedge-hyssop have been discovered in recent years, both the quality and quantity of available habitat have declined during the same time period as vernal pools have been removed for agricultural and urban development and damaged by overgrazing and off-road vehicle traffic (California Department of Fish and Game 1992, 1998; Corbin et al. 1994; California Natural Diversity Database 2002). Populations have also been disturbed or extirpated by hydrologic alteration and by disking and grading (Kaye et al. 1990; California Natural Diversity Database 2002).

Several populations in Modoc County are threatened by competition from Medusa-head (*Taeniatherum caput-medusae*) (Corbin et al. 1994). Several of the small occurrences (less than 100 plants observed) are undergoing rapid declines and are in danger of extirpation from chance events (Menges 1991; California Natural Diversity Database 2002). The 47 occurrences of Bogg's Lake hedge-hyssop located on U.S. Forest Service or U.S. Bureau of Land Management lands may be threatened by grazing, logging activities, recreational use, hydrologic alteration, road construction, fire suppression activities, competition from annuals, and herbicide drift (Corbin et al. 1994; California Natural Diversity Database 2002).

Grazing and trampling may threaten several of the approximately 48 occurrences that are known to be grazed (California Natural Diversity Database 2002). Grazing is detrimental if livestock use is concentrated in a small area or if it occurs before seed set. Grazing may be a compatible land use if it

occurs after seed set (Mason and Bacigalupi 1954; California Department of Fish and Game 1987). Additional studies are needed to establish compatible grazing standards.

Conservation Considerations

Status of Recovery Planning

No state or federal recovery plan has been prepared for Bogg's Lake hedge-hyssop. A Vernal Pool Recovery Plan is currently being prepared by the U.S. Fish and Wildlife Service (USFWS) which would include habitat for Bogg's Lake hedge-hyssop, although it would not specifically include the species. In addition, USFWS recently proposed vernal pool critical habitat for eleven federally listed vernal pool plants. The proposed vernal pool critical habitat covers federally listed species. Accordingly, it does not specifically address Bogg's Lake hedge-hyssop; however, vernal pools that would support Bogg's Lake hedge-hyssop are included in the proposed critical habitat.

Compatible Land Uses

Currently, lands containing occupied vernal pool habitat are utilized for agriculture (grazing), recreational use, and timber harvest; however, the full effects of these uses on Bogg's Lake hedge-hyssop have not been evaluated.

Conservation Needs

Reserves managed for this species should include numerous vernal pools in conjunction with their upland watersheds. Reserves should be large enough to be self-buffered from adjacent land use, especially urban development, agriculture, or other intensive uses.

Data Gaps and Conservation Implications

Primary data gaps that may affect the Bogg's Lake hedge-hyssop conservation strategy include whether the three known populations are still extant; the existence of historic or additional undocumented populations in the Phase 1 Planning Area; the short- and long-term indirect effects of existing roads and other features adjacent to the populations; information on the species' life history and specific habitat requirements; potential competitors of Bogg's Lake hedge-hyssop; and the genetic relationships of extant populations. These data gaps, their implications for the success of the conservation strategy, and methods to remedy these gaps are addressed.

The most recent data indicate that there are 85 extant populations of Bogg's Lake hedge-hyssop throughout its range. Most of the data have been compiled in the last 10 years (Kaye et al. 1990; California Natural Diversity Database 2002). Due to the brief survey window for finding Bogg's Lake hedge-hyssop, and because the plants are small and inconspicuous, it is likely that other undiscovered populations exist. Recently discovered occurrences that are not yet recorded in the CNDDDB are also likely to exist.

The indirect effects of existing development adjacent to extant populations may limit the ability to preserve these populations. Ongoing monitoring of Bogg's Lake hedge-hyssop populations near roads and other development is needed to assess the potential hydrologic effects of a limited buffer area on the ability of these populations to persist. Additional management of these populations, including alteration of existing buffer areas to reduce indirect impacts, might be required for preservation.

The current knowledge of the life history and specific habitat requirements of Bogg's Lake hedge-hyssop is limited but indicates that the species is self-pollinated, that seeds may be dispersed by birds or some

other vector, that seeds may remain dormant for at least 3 years, that suitable vernal pool habitat in the Phase 1 Planning Area is probably on adobe clay soils, and that grazing should occur outside of the growing period through seed set to avoid adverse effects on the species (Mason and Bacigalupi 1954; Kaye et al. 1990; Corbin et al. 1994; California Natural Diversity Database 2002). Gaps in the current knowledge include the possibility of cross-pollination; the period for which dormant seed remains viable (i.e., the species' ability to survive prolonged drought); seed germination requirements (i.e., the effects of varying hydroperiod); the role of wildlife (most likely birds) in seed dispersal; the specific soil types and characteristics that support the species at the known occurrences; the effects of various managed grazing regimes (i.e., the potential for managed grazing to enhance habitat by reducing competition from nonnative annuals); and potential plant competitors. The best method for addressing these questions is to preserve and monitor existing successful populations, as well as to encourage and document research studies on the existing populations throughout the species' range. Information from studies designed to address these data gaps can be used for adaptive management of habitat; management strategy could include restrictions on traditional land uses and develop the use of grazing as a management tool. Information on life history and habitat will assist in identifying potential threats to the species' survival and its tolerance for varying conditions. Information on habitat requirements can also help to identify suitable habitat for introduction of Bogg's Lake hedge-hyssop seed collected from a genetically appropriate nearby population. Frequent but relatively simple studies entailing monitoring of hydroperiod and responses to grazing could be designed by a professional ecologist and conducted by trained volunteers (e.g., California Native Plant Society volunteers, students).

The existing information regarding the genetic relationships of the extant populations is not sufficient to accurately distinguish population relationships, establish the distance of seed dispersal to clarify the limits of individual populations, or identify seed sources for introduction of Bogg's Lake hedge-hyssop into suitable, unoccupied habitat. Technical and labor-intensive studies on population genetics and seed dispersal might best be accomplished as university student research projects.

If research on the species' life history, habitat requirements, and population genetics are not conducted, the potential for developing adaptive management techniques and for expanding the occupied habitat by introducing seed into suitable habitat may be limited.

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